

Advanced Liquid Cooling and Ventilation Garment, Phase I

Completed Technology Project (2018 - 2019)



Project Introduction

NASA is currently pursuing an advanced space suit portable life support system (PLSS) for future missions that could reach the moon or Mars. The Liquid Cooling and Ventilation Garment (LCVG) is a critical component of the PLSS and improvements are needed to reduce weight and improve comfort and mobility. NASA research has shown that the LCVG tubing is a significant heat transfer bottleneck because of the low tubing thermal conductivity and high thermal resistance between the tubing/garment and the body. Previous research at Mainstream developed innovative techniques for improving tubing thermal resistance. Leveraging this work, Mainstream proposes to develop next-generation tubing that improves LCVG performance. In Phase I, Mainstream will establish a baseline thermal model and experimentally demonstrate performance improvements from different tubing configurations. In Phase II, Mainstream will use the new tubing design to create a full scale LCVG and test its performance in a representative environment.

Anticipated Benefits

The proposed research is targeted at next generation Liquid Cooling and Ventilation Garments. Future missions will require demanding extra vehicular activities on the international space station, moon, and mars. Our technology will enable smaller cooling garments and/or smaller heat rejection systems for these missions.

Innovative liquid cooling garment are useful in any working environment where the worker is enclosed in a protective suit. One example use is with firefighting PPE. With this technology, firefighters will be able to face extreme conditions for longer periods of time. Other potential commercial markets include hazmat cleanup crews, paint booth workers, automotive racing, and soldiers.



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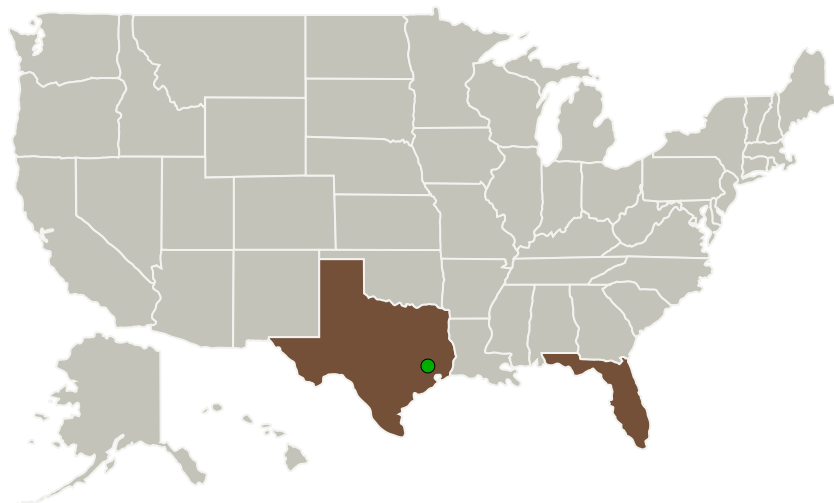
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Mainstream Engineering Corporation	Lead Organization	Industry	Rockledge, Florida
● Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations

Florida	Texas
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Project Transitions

▶ **July 2018:** Project Start

✓ **February 2019:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/141248>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Mainstream Engineering Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

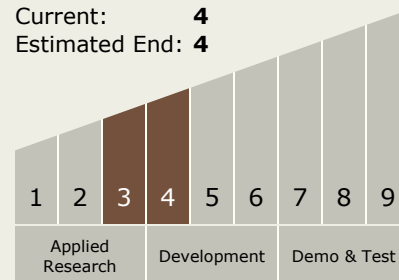
John Bustamante

Technology Maturity (TRL)

Start: **3**

Current: **4**

Estimated End: **4**



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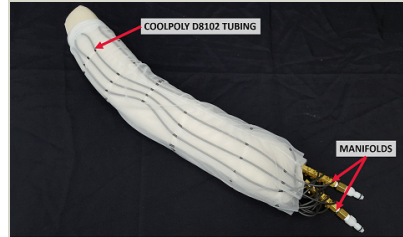


Images



Briefing Chart Image

Advanced Liquid Cooling and Ventilation Garment, Phase I
(<https://techport.nasa.gov/image/136889>)



Final Summary Chart Image

Advanced Liquid Cooling and Ventilation Garment, Phase I
(<https://techport.nasa.gov/image/127373>)

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.2 Extravehicular Activity Systems
 - └ TX06.2.2 Portable Life Support System

Target Destinations

The Moon, Mars